ABUNDANCE, COMPOSITION AND DISTRIBUTION OF MUSKOXEN ON SOUTHEASTERN VICTORIA ISLAND

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ABUNDANCE, COMPOSITION AND DISTRIBUTION OF MUSKOXEN ON SOUTHEASTERN VICTORIA ISLAND

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ABSTRACT

To document the distribution and abundance of muskoxen (Ovibos moschatus) on southeastern Victoria Island, a systematic transect survey was flown between 13-19 March, 1983. The total number of muskoxen counted was 1411; 636 on-transect and 775 off-transect. The mean density was 0.08 muskoxen/km^2 and the corresponding population estimate 3300 ± 345 (S.D.). Mean herd size was 10.5 ± 5.5 (S.D.) and the proportion of short-yearlings observed from the air was 16.1% (51/317). Ground composition counts immediately following the aerial survey resulted in a short-yearling count of 20.3% (60/295) or 66 short-yearlings per 100 cows, 3 years old and older. The large segment of subadult age classes represented by the 1 to 3-year-old cohorts (46% of all muskoxen classified) suggests an expanding population on southeastern Victoria Island. An increase in the current quota, an extension of existing management areas and an earlier season opening are recommended.

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INTRODUCTION

Historical information on muskox distribution and abundance on Victoria Island is sparse and the importance of the island to the species has only recently been confirmed. Until 1980, this large central arctic island had not been systematically surveyed for wildlife nor had it been a study area for muskox research (Urquhart, 1982). In his status report of muskoxen, Urquhart (1982) guessed there were about 45,000 muskoxen in the Northwest Territories. Jakimchuk and Carruthers (1980) systematically surveyed Victoria Island and estimated 12,000 muskoxen, which is 27% of the current estimated population in Canada.

On southeastern Victoria Island, residents of Cambridge Bay hunt muskoxen in two management areas (B-2-4 and B-2-5). The areas and quotas are based on reconnaissance-type surveys done in 1976 (Spencer, 1976) and 1979 (Boxer, 1979). The paucity of information on muskox distribution and abundance has resulted in the maintenance of conservative quotas. Local reports of an expanding population coupled with an increased demand for consumptive use of muskoxen were identified in a muskox management plan for the Kitikmeot Region (Jingfors, 1983). The management plan recommended systematically surveying southeastern Victoria Island, specifically an area within 160 km of Cambridge Bay. Reported here are the results of an aerial transect survey, followed by ground composition counts, of muskoxen in this area during March 1983.

METHODS

I used a Cessna-185 aircraft on wheel/skis to fly a non-stratified, systematic transect survey of muskoxen on southeastern Victoria Island. Transect lines were 3.0 km wide, located at 15-km intervals and perpendicular to the longest axis of the survey area. The transects ran across the shorter dimension of the survey area to increase the number of sampling units and reduce sampling error (Norton-Griffiths, 1978). The 1.5-km strip on each side of the aircraft was marked with 2-m lengths of blue cord held to the wing struts by hose clamps. In flight, the cord streamed out, marking the outer edge of the strip; the outside of the airplane's ski delimited the inner edge of the strip. Markings on the window also helped the observers judge strip width. The markers were positioned according to the formula provided by Norton-Griffiths (1978) and later checked against known distances along the Cambridge Bay air strip while flying at the survey altitude of 300 m agl; airspeed was maintained at 160 kmph.

The pilot acted as navigator and marked the observations on 1:250,000 scale topographical maps. Two observers in the rear continuously searched for and counted total numbers of muskoxen, either as on- or off-transect; the number of short-yearlings (10-11 months old) were counted whenever possible. The information was transmitted on a Sigtronics 4-way intercom system and recorded on data sheets by the front-seat passenger who also acted as an observer. The pilot and front-seat observer usually spotted muskoxen first and obtained initial counts that were checked against the counts given by the observers in the rear. Photographs were taken of large herds (>20 muskoxen) using an automatic 35 mm camera with a 80-200 mm zoom lens.

Transect data were transcribed daily on summary sheets and descriptive statistics were calculated on an Apple II computer using a census data program

based on Jolly (1969), method 2. A polar planimeter was used to calculate survey area. Differences between percentage recruitment by observation method were tested using an angular transformation, as recommended by Sokal and Rohlf (1969, p.607).

Ground composition counts of muskox herds were done from snowmobiles immediately following the aerial survey. Herds accessible (within 100 km) from Cambridge Bay were located based on distributional information from the aerial survey. One week later, additional composition counts of herds in the survey area were obtained during a polar bear denning survey (Jingfors and Kaomayok, 1984).

To minimize muskoxen responding to the snowmobiles by grouping together, most herds were observed from elevated vantage points at distances of 1 km or more. Zoom spotting scopes (20-60x) were used to classify muskoxen as adults, 3-year-olds, 2-year-olds, and short-yearlings. Ageing and sexing were based on criteria of horn development and body size (Smith 1976, Henrichsen and Grue 1980). Representative slides of the different age and sex categories were used to train the observers prior to the survey.

RESULTS

Aerial Survey

A total of 26 hours were flown between 13-19 March, 1983. About 18 hours were flown on transects (n=20) totalling 2790 km that covered 19.2% (8358 km^2) of the survey area (43,420 km^2).

The total number of muskoxen counted was 1411; 636 on-transect and 775 off-transect (Appendix A). The mean density of muskoxen was 0.08 muskoxen/km^2 and the corresponding population estimate was 3300 ± 345 (S.D.). The muskoxen observed were relatively evenly distributed throughout the survey area resulting in a precise estimate with a low coefficient of variation (C.V. = 10%).

Concentrations of muskoxen were observed on Collinson Peninsula, south of Albert Edward Bay and north of Ferguson Lake (Fig. 1). Few muskoxen were seen in the west end of the survey area, west of Wellington Bay. Most muskoxen seemed to be on elevated areas; there was no apparent selection for river drainages or low-lying areas. Signs of cratering were generally restricted to the immediate vicinity of the herds suggesting limited movements during this time of the year.

Mean herd size, based on 134 herds observed and excluding 4 lone bulls, was 10.5 ± 5.5 (S.D.) with a range of 2-27. The proportion of single-sex groups (bulls only) was 11.9%. Including lone bulls, single-sex groups and mixed-sex groups for which classification was attempted from the air, the proportion of short-yearlings to total classified was 16.1% (51/317).

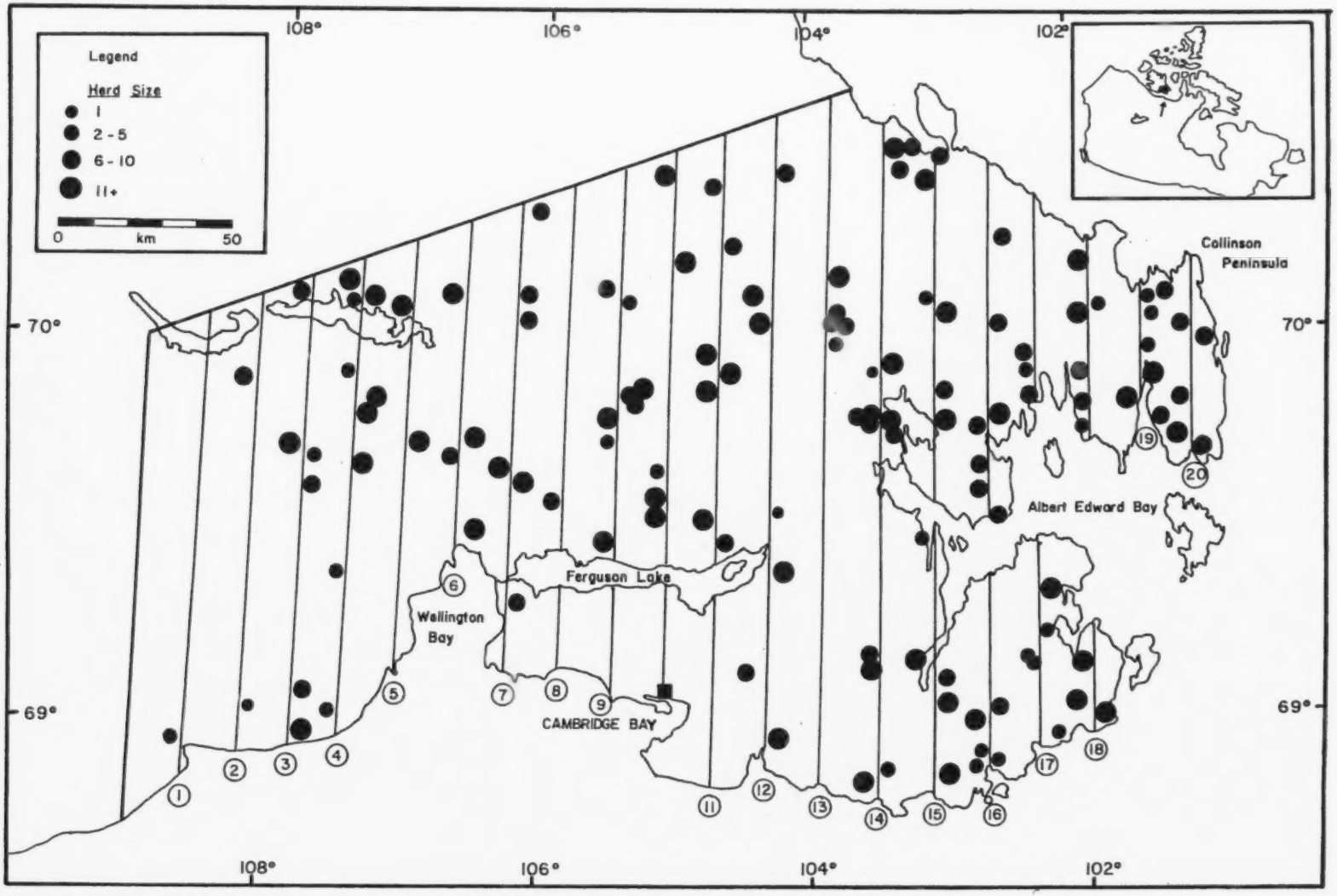

Figure 1. Distribution of muskox herds on southeastern Victoria Island in relation to systematic transect lines flown between 13-19 March, 1983.

Ground Survey

Immediately following the aerial survey, muskoxen were classified from the ground during a 400-km trip on snowmobiles in an area east and northeast of Cambridge Bay (22-25 March, 1983). Muskoxen visible along the travelling route were also classified during the polar bear denning survey, both in the area surveyed by fixed-wing aircraft and further north (01-22 April, 1983).

A total of 295 muskoxen in 29 herds (excluding 2 lone bulls) were classified on southeastern Victoria Island during the two ground surveys (Appendix B). Mean herd size (10.3 ± 7.9; range 2-34) was similar to that observed during the aerial survey (Table 1). The proportion of short-yearlings to total muskoxen classified was 20.3% (60/295), and was not significantly different from the proportion observed during the aerial survey (16.1%). Muskoxen < 4 years old ("subadults") represented 45.8% (135/295) of the total. The short-yearling to cow ratio was 66 short-yearlings per 100 cows, 3 years old and older. The sex ratio was almost even; 118 males to 116 females. Only 7 3-year-old females were classified, compared with 21 3-year-old males. The difference is likely a result of the relative difficulty of recognizing females in this cohort.

Muskoxen on Storkerson Peninsula and Stefansson Island were also classified during the polar bear denning survey (Appendix C). Mean herd size of the 111 muskoxen observed was smaller (7.9 versus 10.3) and the proportion of short-yearlings among the 70 muskoxen classified significantly lower (10.0% versus 20.3%; $P < 0.05$) than on southeastern Victoria Island (Table 1).

The snow in most areas was shallow, 10-15 cm deep, and consisted of an upper crust (2-3 cm) of harder, windpacked snow on top of loosely packed depth hoar ("pukak" - Pruitt, 1959). There were no signs of icing in the snow cover and the upper crust could easily be broken. Most feeding craters examined

Table 1. Herd characteristics of muskoxen observed during spring aerial and ground surveys, eastern Victoria Island, 1983.

Characteristics	Aerial survey	Ground surveys	
		SE Victoria Isl.	NE Victoria Isl.
No. of muskoxen observed	1411	301	111
Mean herd size (+S.D.) Range	10.5 ± 5.5 2 - 27	10.3 ± 7.9 2 - 34	7.9 ± 4.1 4 - 18
No. of muskoxen classified (% of total observed)	317(22.5)[a]	295(98.0)	70(63.1)[b]
No. of short-yearlings (% of total classified)	51(16.1)	60(20.3)	7(10.0)
No. of short-yearlings per 100 cows 3 yrs+	-	66	28
Sex ratio (males:females)[c]	-	118:116	35:28

[a] Includes lone bulls, single-sex groups and the mixed-sex groups where classification was attempted. Only short-yearlings versus "others" were recorded.

[b] Only muskoxen that were easily accessible along the survey route were classified.

[c] Includes muskoxen older than 1 year.

contained willow (Salix spp.) leaves and the green basal parts of various graminoids (primarily Eriophorum spp. and Carex spp.). Many feeding craters also contained fecal matter from ptarmigan (Lagopus mutus). The birds apparently used areas already cratered by muskoxen; several flocks were observed near, or in the middle of, muskox herds.

DISCUSSION

Survey Design

The absence of well-defined river drainages and the relatively flat and homogenous landscape of southeastern Victoria Island were assumed *a priori* to reduce the clumping of muskox herds by topographic features such as river drainages. Consequently, a simple non-stratified transect survey was used. At about 20% coverage, the resulting population estimate was precise with a low coefficient of variation (10%). The effective coverage could have been increased by using wider transects. At 300 m agl, muskoxen were highly visible against the snow and smaller herds (< 20 muskoxen) could easily be counted up to 3 km on either side of the aircraft (twice the strip width actually used).

When large herds were encountered, visual counts were checked against photographs. In three cases (herds of 21, 21 and 23 muskoxen), visual and photo counts were similar; in the remaining two cases, muskoxen were bunched by the time the photos were taken and counting was impossible. Herds did not usually bunch during a single pass at 300 m agl over a herd. As muskoxen were highly visible, the pilot and front-seat observer often obtained initial counts and alerted the back-seat observers to the presence of muskoxen. Bunching occured in some cases as the plane passed directly overhead, or close to, the muskoxen; usually, at that stage, counts had already been done.

While individual herd counts from the aerial survey are likely accurate, the short-yearling count as a proportion of the total is probably an underestimate. Short-yearlings are not easily seen particularly if there is a tendency among the animals to bunch up. The smaller body size of calves is diagnostic but by spring, this difference is less apparent, particularly at

300 m agl while flying at the survey speed of 160 kmph. Ground composition surveys are essential to obtain reliable estimates of recruitment.

Population Characteristics

The only other systematic transect survey of muskoxen on southeastern Victoria Island (Jakimchuk and Carruthers, 1980) resulted in an imprecise estimate (C.V. = 68%; Table 2) for the stratum that included this part of the island. Survey coverage was low (3%) and only 91 muskoxen were counted. Jakimchuk and Carruthers found the highest number of muskoxen on the northwestern part of Victoria Island, in areas of elevational diversity. They felt the absence of elevational diversity on southeastern Victoria Island could limit muskox distribution and abundance, particularly during winter.

The present estimate of 3300 muskoxen, with a density of 0.08 muskoxen/km^2 suggests that southeastern Victoria Island currently supports an expanding population. The density of animals is identical to the overall density of muskoxen found on northwestern Victoria Island in August 1983 (Jingfors, in prep.) During a muskox survey of Banks Island in July 1982, Latour (in prep.) found an overall density of 0.15 muskoxen/km^2; the Thomsen River drainage supported 0.93 muskoxen/km^2. Thomas et al. (1981) suggested that the best muskox habitat below 200 m in Canada could support 1-2 muskoxen/km^2 on a year-round basis assuming winters were not too severe. Their observations were mainly from the Bailey Point peninsula on Melville Island where densities between 1972-80 varied from 0.6 - 1.1 muskoxen/km^2. While southeastern Victoria Island does not compare with muskox "hot-spots", such as Bailey Point and Thomsen River, the density of muskoxen is similar to the northwestern part

Table 2. Summary of muskox survey information from southeastern Victoria Island.

Year(Mon)	Survey type[a]	Population est.(C.V.)	Coverage	Total count	Calf/ total(n)	Lone bull/ total(n)	Herd size (mean±SD)	Range	Reference
1983(Mar)	Tr	3300(10%)	20%	1411	16.1%(317)	0.3%(1411)	10.5±5.5	2-27	This study
1983(Mar)	Gr	-	-	301	20.3%(295)	0.7%(301)	10.3±7.9	2-34	This study
1982(Aug)	Re	-	-	364	17.0%(364)	10.4%(364)	7.6±5.5	2-26	Decker (unpubl. data)
1981(Aug)	Re	-	-	146	14.8%(135)	8.9%(146)	7.0±3.1	2-12	Decker (unpubl. data)
1980(Aug)	Tr	1760(68%)[b]	3%	91	?	3.2%(91)	?	?	Jakimchuk and Carruthers (1980)
1979(Nov)	Re	-	-	525	23.1%(424)	0.2%(525)	10.1±6.0	2-26	Boxer (1979)
1976(Jul)	Re	-	-	215	16.7%(215)	3.8%(181)	8.0±4.3[c]	2-17	Spencer (1976)

[a] Refers to transect(Tr), ground(Gr) and reconnaissance(Re) surveys.

[b] Represents the estimate from Stratum D; see Jakimchuk and Carruthers (1980).

[c] Calculated from original survey maps on file at the Department of Renewable Resources, Cambridge Bay.

of the island and only slightly lower than Banks Island. Thus, the apparent absence of elevational diversity on southeastern Victoria Island, as suggested by Jakimchuk and Carruthers (1980), has not limited muskox distribution or abundance.

The large proportion of short-yearlings (20.3%) classified during the ground survey indicates high survival of calves through the 1982/83 winter. The observed snow conditions suggest that forage was readily available throughout most of the winter. The large segment of subadult cohorts (< 3 years old) in 1983 and the high calf counts obtained by Decker in 1982 and Boxer in 1979 (Table 2) further suggest an expanding population. In recent years, an increasing number of muskoxen have been reported by local hunters; in summer, lone bulls or small herds can be seen within 15 km of Cambridge Bay.

Seasonal differences in mean herd size and in the proportion of lone bulls observed among muskoxen in the study area (Table 2) are consistent with reports from other areas (Tener 1965, Spencer and Lensink 1970, Miller et al. 1977). In winter, herds are generally larger and lone bulls are seldom observed. Herds fracture into smaller groups during summer and particularly in July-August as the rut approaches; at this time, lone bulls are commonly seen (Tener 1965, Gray 1973). Herd sizes recorded on southeastern Victoria Island in summer (Decker, Table 2) are similar to the mean size of 7.1 muskoxen observed for the entire island by Jakimchuk and Carruthers (1980). Herd sizes on the mainland tend to be larger; Gunn and Case (1983) reported a mean herd size of 13.2 in August 1982 in the Queen Maud Gulf area, and Tener (1965) noted an average group size of 11.3 in summers between 1951-1962 in the Thelon Game Sanctuary. The differences observed are probably influenced by foraging conditions and by muskox density, affecting the probability of herd

encounters.

The lack of linear transect surveys in the study area makes comparisons of muskox distribution between seasons and years difficult. In both 1981 and 1982, Decker (unpubl. data) found muskoxen dispersed throughout most of southeastern Victoria Island during the summer, a pattern not unlike that found during this spring survey. While the extent of seasonal movements is not known, it is unlikely that major distributional shifts of muskoxen occur in this area between summer and winter. The predominantly low-lying areas of southeastern Victoria Island provide muskoxen with extensive sedge meadow habitats along lake margins and river drainages. The shallow snow cover would allow muskoxen to use the vegetation in this habitat year-round resulting in overlapping seasonal ranges.

Information on seasonal movements, dispersal and herd dynamics can best be obtained by monitoring marked muskoxen. Successful techniques to capture and mark muskoxen have been developed and most recently tried on Greenland (Strandgaard et al., in press) and in Alaska (Reynolds, in press; Smith, 1983). The proximity of muskoxen to Cambridge Bay would significantly reduce the costs of a marking program and subsequent monitoring.

Management

There are two management areas on southeastern Victoria Island (B-2-4 and B-2-5) with a combined quota of 13 animals. Due to the proximity to Cambridge Bay, the quota is usually filled early in the season (01 Aug.-31 March). Muskoxen have been taken out of season in June and July, when caribou are not readily available in the vicinity of Cambridge Bay and muskoxen provide the

only source of fresh meat. Some animals are also taken outside the management areas and closer to the settlement. A muskox sport hunting program has been discussed between the local Hunters and Trappers Association and Kitikmeot Arctic Tours Ltd.; this program may come underway in 1984 or 1985. Other uses include recreational viewing and photographing of muskoxen which are activities appreciated by local residents as well as by visitors.

The present muskox quota on southeastern Victoria Island is 0.4% of the population estimate. A review of existing muskox management regulations in the Kitikmeot Region is currently underway in an attempt to adjust quotas to local needs while maintaining safe allowable harvest levels that can be sustained over a number of years. Levels between 2-3% of estimated population size seem reasonable for most areas considering our present knowledge of muskox population dynamics.

The quotas and management area boundaries for southeastern Victoria Island were established on the basis of reconnaissance-type surveys made in 1976 (Spencer, 1976) and 1979 (Boxer, 1979). Large areas received little or no coverage, including the area east of Cambridge Bay where local concentrations of muskoxen were observed during this survey. Current distributional information does not support the existence of two distinct management areas (B-2-4 and B-2-5) nor is it reflected in the boundaries of these areas. While it is unlikely that muskoxen on southeastern Victoria Island constitute a discrete "population", muskoxen are sufficiently sedentary, year-round, to justify an area management approach over wide geographical areas that include specific local concentrations.

To provide for a source of fresh meat, an earlier opening of the season (i.e. 01 July) would allow hunters, legally, to take muskoxen when caribou are not readily available in the summer. While hunting of muskoxen should be

discouraged prior to, and during calving (April - June), there is little reason to believe that a summer and early fall season would cause undue harassment and interfere with the rut. The impact on the muskox population will likely be small as summer travelling on the land is limited at present to areas near the coastline.

RECOMMENDATIONS

1. The current quota of 13 muskoxen should be increased to 65 (1.9%) to satisfy local, multiple-use demands, limit illegal take over and above the current quota, and provide tags for potential muskox sport hunts in the future. No sex distinction in the quota is necessary at the proposed, conservative harvest level. The season should open earlier, on 01 July (currently 01 August).

2. The current management areas (B-2-4 and B-2-5) should be combined and extended to include the entire southeastern part of Victoria Island, similar to the survey area (Fig. 1). Muskox hunting should not be allowed to occur in the immediate vicinity of Cambridge Bay; e.g. in the area bounded by Wellington Bay, Ferguson Lake and Anderson Bay (about 30 km around the settlement). Given local support, a no-hunting area recognizes the need for multiple-use of muskoxen in a settlement that has the largest proportion of non-GHL (General Hunting Licence) holders in the Kitikmeot Region and where muskox viewing is advertised for tourism promotion.

3. A limited marking program of muskoxen should be attempted in the Cambridge Bay area. An initial effort should focus on the capture and marking of about 10 muskoxen using snowmobiles in the fall (Oct.-Nov.). The animals should be equipped with numbered ear tags to allow for individual identification. Subsequent monitoring should be done regularly from the ground to collect information on dispersal, movements and possible effects of the marking procedure on individual muskoxen. Local support and involvement is vital for the program to gain acceptance.

4. A linear transect survey of southeastern Victoria Island should be repeated in 1986. Ground composition counts should occur annually to monitor productivity and recruitment. If travelling conditions permit, ground surveys should be done in early June to permit an accurate estimate of calf production. Whenever possible, information on animal condition (fat reserves, reproductive status, etc.) should be gathered by accompanying local hunters during muskox hunts.

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Appendix A. Numbers of Muskoxen, Including Short-Yearlings, Observed on Southeastern Victoria Island, March 1983.

Transect number	Transect area(km^2)	On transect		Off transect	
		Left	Right	Left	Right
1	366.0	0	0	0	2
2	390.0	8	1	0	0
3	399.0	34	9	5	15
4	399.0	16	23	11	65
5	351.8	0	15	14	0
6	276.0	12	16	9	14
7	410.3	39	21	6	0
8	408.8	8	0	0	0
9	452.3	41	0	0	47
10	547.5	0	30	24	15
11	564.8	33	13	39	11
12	570.0	12	37	31	55
13	600.0	21	0	27	0
14	607.5	9	24	61	63
15	551.3	63	13	20	19
16	486.8	26	26	27	30
17	402.0	16	7	0	16
18	277.5	17	0	69	24
19	135.0	8	14	17	0
20	162.8	15	9	29	10
Total	8358.4	378	258	389	386

Appendix B. Age and Sex Composition of Muskoxen Classified from the Ground, Southeastern Victoria Island, 1983.

Location	Date	Herd size	Adult M	Adult F	3-yr old M	3-yr old F	2-yr old M	2-yr old F	Short-yearling[a]	Unclassified
SW. Albert Edward Bay	22 March	24	3	7	3	1	2	1	5	2
		17	5	4	3	0	2	1	2	0
		2	2	0	0	0	0	0	0	0
	23 March	21	3	6	2	2	1	2	5	0
		4	4	0	0	0	0	0	0	0
		3	3	0	0	0	0	0	0	0
		9	1	3	1	0	2	0	2	0
		19	1	6	2	0	1	2	5	2
W. Albert Edward Bay	23 March	34	4	9	3	2	4	2	8	2
		2	2	0	0	0	0	0	0	0
	24 March	1	1	0	0	0	0	0	0	0
		3	3	0	0	0	0	0	0	0
		5	5	0	0	0	0	0	0	0
		19	1	6	1	0	2	2	6	0
		1	1	0	0	0	0	0	0	0
N. Ferguson Lake	25 March	4	4	0	0	0	0	0	0	0
		17	4	6	0	0	1	2	4	0
		12	0	4	0	0	1	3	4	0
N. Albert Edward Bay	2 April[b]	15	3	3	0	1	2	4	2	0
		10	1	3	1	1	1	0	3	0
		12	3	2	2	0	1	2	2	0
Denmark Bay	3-4 April[b]	5	1	2	0	0	0	0	2	0
		3	3	0	0	0	0	0	0	0
		5	2	2	0	0	0	1	0	0
		14	0	7	2	0	1	0	4	0
		2	2	0	0	0	0	0	0	0
		13	2	6	0	0	1	2	2	0
		5	2	1	1	0	0	1	0	0
		8	1	4	0	0	0	0	3	0

Appendix B. (continued)

Location	Date	Herd size	Adult M	Adult F	3-yr old M	3-yr old F	2-yr old M	2-yr old F	Short-yearling[a]	Unclassified
NW. Ferguson Lake	22 April	8	4	3	0	0	0	0	1	0
		4	4	0	0	0	0	0	0	0
Total		301	75	84	21	7	22	25	60	6
Proportion (%)[c]			25.4	28.5	7.1	2.4	7.5	8.5	20.3	2.0

[a] Refers to muskoxen 10-11 months old.

[b] Observations were made while on a polar bear denning survey (Jingfors and Kaomayok, in prep.)

[c] Based on 295 classified muskoxen.

Appendix C. Age and Sex Composition[a] of Muskoxen Classified from the Ground, Northeastern Victoria Island, 1983.

Location	Date	Herd size	Adult		3-yr old		2-yr old		Short-yearling[b]	Unclassified
			M	F	M	F	M	F		
Storkerson Peninsula	5 April	8	1	4	0	0	0	0	3	0
	7 April	4	4	0	0	0	0	0	0	0
	9 April	4	2	1	0	0	0	0	1	0
		11	3	4	0	1	2	1	0	0
Stefansson Island	11 April	4	3	0	1	0	0	0	0	0
		8	1	3	1	0	1	0	1	1
Storkerson Peninsula	14 April	4	2	0	0	0	0	0	0	2
S. Hadley Bay	21 April	18	5	7	3	0	2	1	0	0
		12	2	5	1	0	1	1	2	0
Total		73	23	24	6	1	6	3	7	3
Proportion (%)			32.9	34.3	8.6	1.4	8.6	4.3	10.0	4.3

[a] These observations were made north of the study area (Fig.1) during a polar bear denning survey and are included for comparative purposes.

[b] Refers to muskoxen 10-11 months old.

[c] Based on 70 classified muskoxen.